

EIGHTH ANNUAL REPORT

OF THE

OHIO AGRICULTURAL

EXPERIMENT STATION

FOR 1889.

Printed by Order of the State Legislature.

COLUMBUS, O.:
THE WESTBOTE COMPANY, PRINTERS.
1890.

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TABLE OF CONTENTS.

BOARD OF CONTROL AND OFFICERS.

ANNOUNCEMENT.

REPORT OF SECRETARY OF BOARD OF CONTROL.

REPORT OF THE BURSAR.

REPORT OF THE DIRECTOR.

REPORT OF THE AGRICULTURIST.

REPORT OF THE HORTICULTURIST.

REPORT OF THE ENTOMOLOGIST AND BOTANIST.

REPORT OF THE VETERINARIAN AND BACTERIOLOGIST.

REPORT OF THE METEOROLOGIST.

THE INSECT RECORD FOR 189.

APPENDIX—THE BULLETIN FOR 1889.

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BOARD OF CONTROL AND OFFICERS
OF THE
OHIO AGRICULTURAL EXPERIMENT STATION.

BOARD OF CONTROL.

SETH H. ELLIS,	.	.	.	.	.	.	.	Springboro.
HON. JOSEPH H. BRIGHAM,	.	.	.	.	.	.	.	Delta.
J. L. McILVAINE,	.	.	.	.	.	.	.	New Philadelphia.
THE GOVERNOR OF THE STATE,	.	.						
THE DIRECTOR OF THE STATION,	.							
			}					<i>Ex-Officio.</i>

OFFICERS OF THE BOARD.

SETH H. ELLIS,	President.
PROF WILLIAM R. LAZENBY,	Secretary.
HON. JOSEPH H. BRIGHAM,	Treasurer.

STATION STAFF.

CHARLES E. THORNE,	Director.
WILLIAM J. GREEN,	Horticulturist and Vice-Director.
J. FREMONT HICKMAN, M. A. S.,	Agriculturist.
CLARENCE M. WEED, M. SC.,	Entomologist and Botanist.
H. J. DETMERS, M. V. D.,	Veterinarian and Bacteriologist.
BERTHA E. WILDMAN,	Bursar and Stenographer.
FREDA DETMERS, B. SC.,	Assistant Botanist.
JOHN A. ALWOOD,	Foreman of the Farm.
EDWIN C. GREEN,	Foreman of the Gardens.
W. H. BAKER,	Meteorologist.

ANNOUNCEMENT.

The Ohio Agricultural Experiment Station is organized under an act of the General Assembly of Ohio, passed April 17, 1882, and supplemented by an act of Congress, approved March 2, 1887.

The Station is prepared to test varieties of grains, fruits and garden vegetables; to examine seeds that are suspected of being unsound or adulterated; to identify and name grasses, weeds and other plants; to investigate and describe the habits of injurious and beneficial insects, and to investigate, and in some cases to suggest measures for the prevention of outbreaks of contagious, parasitic or epizootic diseases of domestic animals.

Any citizen of Ohio, who is concerned in the promotion of agriculture, has the right to apply to the Station for any information it can render, and the Station will cheerfully respond to all such communications, as far as lies in its power.

Address all communications to

EXPERIMENT STATION, Columbus, Ohio.

EXPERIMENT GROUNDS AND OFFICES

ON THE FARM OF THE

OHIO STATE UNIVERSITY, N. HIGH STREET, COLUMBUS, O.

Eighth Annual Report.

REPORT OF THE BOARD OF CONTROL.

To HON. JAMES E. CAMPBELL, *Governor of Ohio* :

SIR: A prominent feature of the agriculture of our age is the ever increasing application of the resources of science to promote the interests of the practical farmer. During the past twenty-five years numerous institutions, known as agricultural experiment stations, have been established in nearly every civilized land, the object being the promotion of agriculture by scientific investigation and experiment. In our country the first station was established in 1875, and since then, by the liberal provisions of the general government, their number has rapidly increased. Although it is too early to judge of the value of the researches made by the various stations recently established in the United States, the constant and increasing demand for their published reports and bulletins evince public appreciation of the work that is being done.

The work of the Ohio Station has gone on without interruption during the year. While there have been no marked additions to the equipment, there has been a steady increase in facilities for accurate experimental work, and a corresponding increase in the amount accomplished during the year. As is well known, the University farm, with its buildings, stock and tools, are now in the hands of the Experiment Station to be used as the best interests of the Station demand.

In some quarters there is a misconception of the proper scope and function of a farm in connection with an experiment station. Some insist that it should annually show a favorable balance sheet, and in this way demonstrate the value of the application of science to practice. Others insist that it should be a "model farm," whereon could be exhibited in a nearly perfect manner the best attainable results in every branch of farm practice. These are worthy objects, and as far as possible should be attained, but they are not the primary object of an experiment station. The prime object is to plan and execute such experiments as are designed

to increase our knowledge of the laws and forces which govern the growth of plant and animal. The adaptability of varieties, the relative value of different fertilizers and methods of culture, the comparative value of different stock foods, the prevention and remedy for diseases of plants and animals, the study of injurious and beneficial insects—these and other similar subjects offer scope for well-trained, painstaking and laborious investigation.

It is the policy of the Board of Control to manage the farm strictly as a means of experimentation, for which purpose it is measurably well adapted. To this end it is expected that the amount of ordinary farm work will be gradually reduced in the future. A certain amount of routine work is necessary, but the less the proportion of such work, and the greater the proportion of strictly experimental work a station does, the more nearly is it fulfilling the purpose for which it was created.

The reports of the Director and other members of the Station staff will give a summary of Station work for the year. It has been thought best to concentrate the means and efforts of the Station upon a comparatively few lines of investigation, and to repeat the study of a few of the more important problems from year to year, until some definite conclusions are reached.

A thorough and exhaustive investigation of a few important questions will result in far greater good to the agriculture of the State than a superficial study of many questions where no conclusions can be deduced.

By the reappointment of the Hon. J. H. Brigham, the Board of Control remains the same as last year, but the following changes have been made in the working staff: Early last spring Mr. W. S. Devol, who held the position of Bursar and Botanist, resigned and went to his new field of labor in Nevada. He was succeeded by the appointment of Miss Bertha E. Wildman as Bursar and Stenographer, and Miss Freda Detmers as Assistant Botanist. To the office of Entomologist, which had been so acceptably filled by Mr. C. M. Weed, the office of Botanist was added. Mr. William Holmes having resigned his position as foreman of the gardens, his place was filled by the appointment of Mr. E. C. Green, and Mr. W. H. Baker was appointed Meteorologist in the place of Mr. M. Craig, who left to take a post-graduate course in Cornell University.

The State appropriation of two thousand dollars was expended for the purposes for which it was granted, viz.: fourteen hundred in the erection of a greenhouse, and six hundred for heating the new Station building. A change in the plan of heating necessitated a larger outlay than had been estimated, and the balance was supplied from sales of farm products.

It is earnestly hoped that the amount asked for this year will be appropriated by our State legislature. Every dollar is needed, and we confidently believe that the people's money can be put to no better use.

The Secretary of the Board of Control desires to publicly express the appreciation of the members of the Board for the loyal interest shown by all the Station officers in carrying out the plans and purposes of the Station, and for the liberal spirit and good will continually manifested by the trustees of the State University.

Respectfully submitted.

WILLIAM R. LAZENBY,
Secretary Board of Control.

REPORT OF THE BURSAR.

SIR: I have the honor to submit herewith a summary statement of the financial operations of the Station for the fiscal year ending June 30, 1889.

The appropriations made by Congress for agricultural experiment stations are made for the fiscal year ending June 30, and each station is required to furnish, annually, a detailed report of the expenditure of such appropriations. This report will be found in Statement A, which is a copy of the report of the Auditor and Treasurer of the Board of Control, made to the Governor of the State, as required by the Hatch act.

Statement B shows the receipts from sales of farm and garden produce, with a statement of the expenditures from this fund.

Statement C is a combination of statements A and B, showing the total receipts and expenditures for the year.

STATEMENT A.

THE OHIO AGRICULTURAL EXPERIMENT STATION IN ACCOUNT WITH THE UNITED STATES TREASURY.

Dr.

1889.

To receipts from Treasurer of the United States, as per appropriation for year ending June 30, 1889, under act of Congress, approved March 2, 1887..... \$15,000 00

Cr.

June 30, by salaries	\$7,700 00
“ labor	3,424 34
“ supplies.....	1,076 92
“ freight and expressage.. ..	89 08
“ printing, postage and stationery.....	871 20
“ library	142 28
“ tools, implements, and repairs of same.....	287 34
“ scientific instruments	30 18
“ general fittings	330 97
“ travel, and expenses Board of Control.....	236 65
“ incidentals.....	46 68
“ buildings.....	744 36
Total.....	\$15,000 00

I, the undersigned, duly appointed auditor for the corporation, do hereby certify that I have examined the books and accounts of the Ohio Agricultural Experiment Station for the fiscal year ending June 30, 1889; that I have found the same well kept and correctly classified as above, and that the receipts for the time named are shown to have been \$15,000.00, and the corresponding disbursements \$15,000.00, for all of which proper vouchers are on file, and have been by me examined and found correct.

S. H. ELLIS, *Auditor Board of Control.*

I hereby certify that the foregoing statement of account, to which this is attached, is a true copy from the books of account of the institution named.

J. H. BRIGHAM, *Treasurer Board of Control.*

STATEMENT B.

OHIO AGRICULTURAL EXPERIMENT STATION IN ACCOUNT WITH PRODUCE FUND.

TO RECEIPTS.

1889.	<i>Dr.</i>	
June 30, from sales of milk.....	\$2,409	26
“ “ agricultural produce	1,392	17
“ “ horticultural produce.....	838	60
“ from labor.....	44	24
Total.....	\$4,684	27
Cash on hands July 1, 1888.....	1,165	29
Total.....	\$5,849	56

BY EXPENDITURES.

1889.	<i>Cr.</i>	
June 30, for labor	\$3,067	60
“ supplies	128	29
“ freight.....	4	00
“ library.....	4	00
“ tools, implements, and repairs of same.....	10	85
“ furniture	33	25
“ general fittings.....	35	25
“ fencing and drainage materials	35	16
“ live stock	80	00
“ travel	7	50
“ incidentals.....	17	14
“ buildings (labor and materials)	2,217	11
Total.....	\$5,640	15
Balance carried forward.....	209	41
Total.....	\$5,849	56

STATEMENT C.

TOTAL RECEIPTS AND EXPENDITURES OF THE OHIO AGRICULTURAL EXPERIMENT
STATION FOR THE FISCAL YEAR ENDING JUNE 30, 1889.

RECEIPTS.

From U. S. Treasury.....	\$15,000 00
From sales of produce.....	5,849 56
Total.....	<u>\$20,849 56</u>

EXPENDITURES.

For salaries.....	\$7,700 00
labor.....	6,491 94
supplies.....	1,205 21
freight and expressage.....	93 08
printing, postage and stationery.....	871 20
library.....	146 28
tools, implements and repairs of same.....	298 19
scientific instruments.....	30 18
furniture.....	33 25
general fittings.....	366 22
fencing and drainage materials.....	35 16
live stock.....	80 00
travel, and expenses Board of Control.....	264 15
incidentals.....	63 82
buildings (labor and materials).....	2,961 47
Total.....	<u>\$20,640 15</u>
Balance carried forward.....	209 41
Total.....	<u>\$20,849 56</u>

EXPENDITURE FOR PERMANENT IMPROVEMENTS.

I also give below a statement showing the amount expended for buildings and other permanent improvements on the Station farm during the fiscal years 1888 and 1889.

STATEMENT D.

EXPENDITURES FOR PERMANENT IMPROVEMENTS FOR TWO FISCAL YEARS, ENDING
JUNE 30, 1889.

For buildings, including material and skilled labor.....	\$5,862 54
" ordinary labor.....	347 16
For fencing and drainage { material.....	276 05
labor.....	488 60
Total.....	<u>\$6,974 35</u>

The sums thus expended are not additional outlay, but are included in the statements of total receipts and expenditures for the two years named.

However, this statement D does not include the appropriation of \$2,000.00 from the State legislature referred to by the Secretary of the Board of Control in his report. As this appropriation was almost entirely expended during the latter half of the calendar year, it will be included in the report for 1890.

Respectfully,

BERTHA E. WILDMAN, *Bursar*.

HON. S. H. ELLIS, *President Board of Control*.

REPORT OF THE DIRECTOR.

SIR: I have the honor of submitting the eighth annual report of the Ohio Agricultural Experiment Station for the year 1889, it being the second report of work performed under the operations of the act of Congress known as the Hatch act.

The season of 1889, in central Ohio, was favorable for the growth of most of the agricultural and horticultural productions of this latitude, and therefore was favorable for the prosecution of the field experimentation, which constitutes the leading feature of the work of this Station. And we sum up the results of the year's work, we feel that, although these results fall far short of what we desired to attain, yet much that is of immediate and positive value to the farmer has been accomplished.

One of the results of this year's work has been to convince us who are engaged in it that the number of lines of investigation must be diminished, or else the resources of the Station increased, if the most effective work is to be done. Each year's additional experience in field experimentation reveals more fully the difficulties to be met in that form of investigation, and at the same time intensifies the conviction that such work is absolutely essential to any progress in scientific agriculture.

To reduce the number of its lines of investigation will inevitably bring upon the Station the criticism of those who may be specially interested in the work which the Station is apparently neglecting. Already the dairymen of the State feel that their industry, unquestionably one of the most important branches of agriculture pursued by Ohio farmers, is receiving scant attention by the Station. But, as was stated in my report a year ago, it has seemed to us that the work begun by the Station under its State organization should be pushed to completion, rather than that it should be dropped, half finished, to undertake new lines of work.

A large proportion of the income of the Station, since its organization under the Hatch act, has been expended in the erection of buildings, the drainage of the farm, and the purchase of live stock, implements, etc., for stocking it, and of scientific apparatus for the more delicate work of the Station. The total cash expenditure for these items, since April 1, 1888, has exceeded \$12,000, in addition to the special appropriations made by the State legislature, and a further expenditure of at least an equal

amount will be required to equip the Station for effective work on its present basis. When this expenditure can be curtailed, it is hoped that some of the work which the Station is now apparently neglecting may receive due attention; but it is evident that if the Station is compelled to provide for this expenditure out of its present income, it must be several years yet before its work can be materially extended.

The National Congress appropriates to each State \$15,000 yearly for the purposes of agricultural experiment. The law under which this appropriation is made expressly provides that not more than five per cent. of this annual appropriation shall be used in the construction or repair of buildings; but even if this proviso were not in the way, it would seem that a sense of honor should impel each State to hold the fund sacred to the purpose for which it is given. In the act accepting the National appropriation for an experiment station, the legislature of Pennsylvania made an appropriation for the Station of \$3,000 per annum for four years, besides a special appropriation for a building. The little State of Connecticut appropriates to its Station \$8,000 per annum, Massachusetts gives \$10,000 yearly, and New York \$20,000 yearly for this work, in addition to the sums received under the Hatch act.

FARM TESTS.

The soil of the farm occupied by the Station represents but a small proportion of the soils of the State, and hence it is necessary that many of the tests made here should be repeated in other sections of the State before final conclusions are drawn. Farmers in various sections of the State are willing and anxious to co-operate with the Station in this work, and we have to acknowledge much valuable assistance rendered by them in the comparative testing of fertilizers and varieties of grain, fruits and vegetables. The work thus far done is proof of the great possibilities that lie before such work in the future, and I confidently hope to see the time when there shall be a branch experiment station, guided by intelligent farmers, in every township of the State. Such sub-stations need not be furnished with the expensive equipment required by the central Station. They need not undertake any of the more elaborate lines of work that require costly apparatus and observers of long training for their conduct; but the simpler field tests—comparisons of varieties, methods of cultivation, etc.—are within the compass of any intelligent farmer. A simple experiment in the comparison of fertilizers of different composition, for example, may be made by any farmer at a trifling cost, and yet the facts revealed by such an experiment may be worth thousands of dollars annually to the farmers of a township.

STUDENT LABOR.

During the calendar year the sum of \$2,627.97 has been paid to students of the University for labor and clerical services performed at the Station. In my report for 1888 I called attention to a plan then under consideration, by which young men might be enabled to spend half their time working for the Station and the other half in attendance upon the classes of the University. This plan was published in full in the agricultural press of the State, and several young men embraced the opportunity offered; but the number of such is extremely small in proportion to the number of young men on the farms of the State who need the training that the University is prepared to give. Notwithstanding the distinct announcement that the opportunity thus offered by the Station would be strictly limited to students in the agricultural department of the University, quite a number of young men have begged for employment, in order that they might enter other departments. We must remind such that the employment of students is in every case a disadvantage to the Station, unless it can secure thereby something better than the pertunctory service to be expected of him whose only interest in the work is inspired by the money to be got out of it.

While the number of students of agriculture seeking employment at the Station is not so large as we should be glad to see it, several are making good use of its opportunities, and are preparing themselves for future usefulness in similar lines of work. In addition to these we have had two young men with us during part of the summer who came to study the practical side of the Station's work, in order to supplement theoretical studies made elsewhere.

THE STATION AND THE UNIVERSITY.

The most cordial relations have existed between the two institutions throughout the year. The officers of the Station are sincerely anxious to afford every possible facility for illustration to the professors of the agricultural department of the University, and we believe that this feeling is fully reciprocated. The professors of that department, with their classes, have frequently visited the Station grounds, while the officers of the Station have had free access to the library and collections of the University, besides other privileges.

PUBLICATIONS.

As explained in my report for 1888, the State law, under which the Ohio Agricultural Experiment Station is organized, provides for the publication by the State of an annual report of the Station, to be published

in the Ohio Agricultural Report, and five thousand copies in pamphlet form for separate distribution. The national law, known as the Hatch Act, under which the Station was reorganized in April, 1888, requires the publication, at intervals of not less than three months, of "bulletins, or reports of progress." As no provision was made for the publication of these bulletins by the State, in the joint resolution of the State legislature, by which the Station was made the beneficiary of the Hatch Act, it became necessary, in order to comply with the requirements of both State and national laws, that the Station should publish a quarterly bulletin, and that the State should republish the substance of this bulletin as the annual report of the Station.

Believing that all interested would be quite as well served by a single publication, the Board of Control requested the last legislature to authorize the publication by the State of the Station's bulletin, which request was granted in the following

JOINT RESOLUTION

Be it resolved by the General Assembly of the State of Ohio, That the bulletins of the Ohio agricultural experiment station shall be printed under direction of the supervisor of public printing, and paid for out of the appropriation for State printing; said bulletins to be printed in advance of other matter, except the crop reports of the state board of agriculture; provided, that the average monthly edition of such bulletins shall not exceed 15,000 copies; that the total number of pages in such bulletins, and the annual report of the station shall not exceed 400 in any one year; and that the annual report of the station only shall be included in the annual report of the state board of agriculture; and provided, further, that the total aggregate expense for printing, binding and paper under this resolution shall not exceed the expense now incurred by the state for printing, binding and paper for said station.

This resolution practically provides for the publication of the annual report of the Station in monthly installments, and thus enables the results of its work to be placed before the farmers of the State within a few weeks after the work is completed; whereas, under the previous system of State publication, nearly a year must elapse between the completion of an experiment and the publication of its results. The above resolution was adopted in March, 1889, and under its authority a monthly bulletin has since been issued by the Station. A brief synopsis of the issues of this bulletin for the year is here given, for the reason that this report is the only publication of the Station that will hereafter be included in the Ohio Agricultural Report, and for the further reason that it seems desirable briefly to review and collect in comprehensive form the results of the Station's work for the year:

BULLETIN No. 1, MARCH, 1889. BY C. M. WEED.

ARTICLE I. *Practical Remedies for some of the most injurious Ohio Insects.* A brief, illustrated description of some of the more common insects which injuriously affect fruits, squashes, melons, potatoes and clover, with an account of the most practical methods for preventing their ravages at present known.

ARTICLE II. *Insecticides and their application.* An enumeration of the principal substances used in combating insects, with directions for use, illustrated descriptions of insecticide machinery, etc.

ARTICLE III. *Directions for collecting, preserving and studying insects.* A brief manual on collecting and preserving insects, followed by a list of elementary works on Entomology, the object of this article being to stimulate the study of insects at home by farmers' boys.

BULLETIN No. 2, APRIL AND MAY, 1889. BY H. J. DETMERS.

ARTICLE IV. *Colic of Horses.* An exhaustive treatise on the causes, symptoms, diagnosis and treatment of this disease, intended for the information of veterinarians as well as of farmers. The assumption of Prof. Bollinger that colic in horses is probably generally caused by aneurisms in the anterior mesenteric artery, due to the presence of a small worm, *Schlerotomum equinum*, is confirmed by experiments made at this Station.

BULLETIN No. 3, JUNE, 1889. BY J. F. HICKMAN AND C. E. THORNE.

ARTICLE V. *Silos and Ensilage.* Illustrated directions for constructing and filling silos, drawn from the experience of the Station.

ARTICLE VI. *Ensilage vs. field beets as food for cows.* The details of an experiment in the comparative feeding of corn ensilage and field beets for the production of milk; the conclusions being that as a part of a ration containing other feeding stuffs, both corn ensilage and field beets will take rank with the better grades of feeding stuffs, and that corn ensilage, as fed in this experiment, is somewhat superior to field beets for the production of flesh, and somewhat inferior for the production of milk.

BULLETIN No. 4, JULY, 1889. BY W. J. GREEN.

ARTICLE VII. *Experiments with small fruits in 1889.* The following is a summary of the conclusions reached:

STRAWBERRIES: The following varieties have been fully tested and can be recommended for general planting: *Bubach, Haverland, Ohio, Pearl, Crescent, Warfield.*

The most promising of the newer varieties are *Eureka, Crawford, Enhance, Miami, Viola.*

The following have special characteristics that fit them for private growers and amateurs: *Jessie, Lida, Louise, Logan, Jersey Queen, Sharpless, Cumberland.*

Those that are still doubtful and require further trial are *Burt, Cloud, Daisy, Dutton, Gandy, Hampden.*

The following will probably soon be discarded: *Belmont, Bomba, Monmouth, Mammoth, Pineapple, Carmichael.*

RASPBERRIES: The following of the newer varieties are recommended for general planting: *Hilborn, Muskingum, Palmer.*

Those that require further trial are *Ada, Johnston's Sweet.*

The following will probably be discarded, or at most, be cultivated in but few localities: *Rancocas, Marlboro, Springfield.*

BLACKBERRIES: The hardiest and most worthy of cultivation in this latitude are *Agawam, Ancient Briton, Bonanza, Early Harvest, Taylor, Snyder*.

The following are valuable for less severe climates: *Erie, Minnewaski, Early King, Lawton, Kittatinny*.

Those not worthy of further trial are *Brunton's Early, Crystal White, Dehring, Early Cluster, Wilson, Jr.*

ARTICLE VIII. *Effect of early and late picking upon the keeping quality of apples.* Winter apples of several varieties were picked at various dates, from September 26 to October 20, and stored in crates in an ordinary cellar. Following are the conclusions reached.

Early picking of apples improves their keeping qualities, but no difference is manifest for nearly six months after picking. If kept for a longer period than six months the early picked apples show a decided gain over those picked late. The greater part of the loss in weight, caused by drying, occurs within six months after picking. The early picked apples lose slightly more in weight than those that are picked late.

BULLETIN No. 5, AUGUST, 1889. BY J. F. HICKMAN.

ARTICLE IX. *Experiments in wheat seeding.* This article reports the experiments made at this Station on the crop of 1888-89 in thick and thin seeding, early and late seeding, and seeding at different depths and by different methods. For comparison, the results of six and eight seasons' experiments in thick and thin seeding and early and late seeding are given, the conclusions deduced from which are that, on good soil, from five to seven pecks of seed may be used more profitably than a larger or smaller quantity, and that at this Station the best results have followed seeding during the last days of September and the first days of October.

ARTICLE X. *Comparative test of varieties of wheat.* About 270 so-called varieties of wheat were cultivated at the Station this year; 69 of these were grown in plots of one-tenth acre each, and 17 had been grown on similar plots for four or more years preceding. Over this five-years' test Early Rice, Finley and Mediterranean have yielded about 31 bushels per acre; Landreth and Democrat about 34 bushels; Egyptian, Theiss, Tasmanian Red, Martin's Amber, Poole and Penquite's Velvet (Velvet Chaff) about 36 bushels; Silver Chaff, Nigger and Diehl-Mediterranean about 37 bushels; Royal Australian, Red Fultz and Valley about 39 bushels. It is probable that several of these so-called varieties are synonymous, and quite certain that many of those in the larger list are so.

BULLETIN No. 6, SEPTEMBER, 1889. BY C. M. WEED.

ARTICLE XI. *Remedies for the Plum Curculio.* Experiments in spraying plums and cherries with arsenites, which indicate that the curculio may be almost completely held in check by this means.

ARTICLE XII. *Remedies for the Striped Cucumber Beetle.* Experiments were made on a large scale, under field conditions, the striped beetles being exceedingly abundant. Hen manure, cow manure, kerosene, carbolic acid, bisulphide of carbon, coal soot and saltpetre proved worthless. Gypsum showed some beneficial effect, but not sufficient to save all the plants. Pyrethrum killed those beetles with which it came in contact when first applied, but soon lost its efficacy. "Slug-shot" injured the plants to which it was applied. "Peroxide of silicates" had a decided effect in preventing injury, and where the plants had been well started before being attacked, it saved them from destruction; but it did not save them where the beetles were so numerous that they burrowed down to meet the sprouting plants. The most satisfactory results by far were obtained from fencing out the insects, by covering the plants with some form of tent or gauze-covered frame.

ARTICLE XIII. *Strawberry Root-louse and Grain Plant-louse.* Experiments with these insects indicate that, when it is desired to transplant strawberry plants infested with the Strawberry Root-louse, we may disinfect them by dipping in a strong kerosene emulsion; but that for overcoming the Grain Plant-louse we must for the present rely upon the lady-bird beetles and various species of parasitic insects that prey upon these lice.

ARTICLE XIV. *Notes on little-known injurious insects, namely:* A new rhubarb beetle, the imported currant worm, the green apple-leaf hopper and the cherry-tree slug. Hellebore is a complete preventive of injury from the currant worm; pyrethrum or tobacco dust for the apple-leaf or rose-leaf hoppers, and hellebore, pyrethrum or London purple for the cherry-tree slug.

ARTICLE XV. *Preventing the injuries of the potato rot.* An experiment in spraying the vines with "Bordeaux Mixture"; from which the following conclusions are drawn, subject to modification by future experiment:

(1.) That a large proportion of the injury done by the potato rot can be prevented by spraying the vines with the Bordeaux mixture.

(2.) That this treatment apparently diminishes the amount of scab affecting the tubers.

(3.) That by adding London purple to the mixture the same treatment may be made effective in preventing the injuries both of the rot and Colorado potato beetle.

BULLETIN No. 7, NOVEMBER, 1889. BY W. J. GREEN.

ARTICLE XVI. *Early Cabbage.* A test of early varieties of cabbage, conducted for the purpose of determining synonyms and to learn the relative value of old and new sorts.

The synonyms determined are: Salzer's Earliest, Buist's Earliest, Extra Early Advance, Everitt's Earliest of All, Rawson's Volunteer, Premier, Faust's Earliest, Johnson & Stokes' Earliest, Landreth's Earliest. These are practically identical, and appear to be strains of Etampes, or that variety renamed.

The comparison of varieties had special reference to determining the relative value of Early Wakefield, Etampes and Express. The conclusion reached is that Early Wakefield is not only earlier than either of the others, but forms a much more solid head; in the latter respect being at least 50 per cent. more valuable than either of the others.

The following varieties were found to have special merit: Early Summer, All Seasons, Chase's Excelsior, Henderson's Succession, Low's Peerless and Louisville Drumhead.

ARTICLE XVII. *Cauliflower.* The early dwarf varieties have been found to be more reliable than the large growing late sorts. The Early Erfurt is the most valuable of all, under which name are included the following named strains: Snowball, Extra Early Seafoam, Early Puritan, Long Island Beauty, Early Padilla, Vick's Ideal, Maule's Prize Earliest. The following are unsuited to this climate: Algiers, Lenormand, Eclipse, Early Paris and Veitch's Autumn Giant.

ARTICLE XVIII. *Puget Sound Cabbage and Cauliflower seed.* A notable difference has been observed between Puget Sound and eastern grown cabbage and cauliflower seed, in vitality of seed and vigor of plants, in favor of the former. Plants grown from Puget Sound seed show a greater vigor than those from eastern seed, in the early stages of growth, but the difference becomes less and less as the season advances, until it disappears altogether. No difference has been observed in earliness or quantity and quality of crop, from Puget Sound and other seed.

In addition to the work reported during 1889, material has been accumulated which will be published in the Bulletin of the Station during the early part of 1890. This will include experiments with corn, oats and potatoes, embracing comparisons of varieties, methods of planting and the effects of commercial fertilizers.

Besides the work published in its regular bulletin, the Station is incidentally doing some work that is of more immediate interest to the scientist than to the farmer. An idea of the general character of this work may be obtained from Bulletin No. 1, Technical Series, issued in October, and which contains three articles, namely :

ARTICLE I. *Preparatory stages of the 20-spotted Lady-bird.*

ARTICLE II. *Studies in pond life.*

ARTICLE III. *A partial bibliography of insects affecting clover.*

Articles I and II deal with insects that, so far as is at present known, are of little economic interest, but a little reflection will convince even those who have least acquaintance with economic entomology, that a knowledge of the habits of other insects is absolutely essential to a complete mastery of those which are injurious.

The utility of Article III to the student of economic entomology will at once be apparent, although the article may possess no immediate interest for the farmer.

THE BULLETIN NOT AN AGRICULTURAL NEWSPAPER.

Some dissatisfaction has been expressed at the irregular publication of the Station's Bulletin; but the function of this Bulletin is not to collect and publish agricultural news, but to report the results of work accomplished at the Station. In many cases, the compilation and tabulation of the data accumulated in an experiment requires more time than that involved in the manual labor of the experiment itself; but this compilation must be made amidst the many interruptions incident to the conduct of other lines of research, and it is therefore frequently absolutely impossible to publish the results of an experiment until several weeks after the experiment has been finished. While, therefore, the Station will endeavor to secure the utmost promptness in publication consistent with accuracy, there will be some unavoidable delays, for which we must ask the indulgence of those interested.

FARMERS' INSTITUTES.

Through the courtesy of Mr. L. N. Bonham, Secretary of the State Board of Agriculture, the officers of the Station have had the privilege of

meeting many of the farmers of Ohio in the farmers' institutes held during the winter of 1888-9. They have also been invited to address numerous other meetings or conventions of farmers, horticulturists and stock breeders. In all, fifty such institutes or other meetings have been attended during the year by the various members of the Station staff. The officers of the Station regard this privilege of meeting the farmers as valuable, not only for the opportunity afforded to place the work of the Station and its results more fully before those for whom the work is done than is possible under the limitations of printed publication, but also and especially for the valuable suggestions the Station workers have themselves received from personal contact with earnest, thinking farmers. We feel that both the Station and the farmers have cause to thank Mr. Bonham for these opportunities for mutual interchange of experience.

ORGANIZATION OF THE STATION.

As the Station is now organized it includes four general departments or divisions of research, each under the charge of a specialist. These are :

- I. Agriculture, including stock feeding and dairying.
- II. Horticulture, or the culture of fruits and garden vegetables.
- III. Entomology and Botany, including the control of insects and plant diseases.
- IV. Veterinary Science, including Bacteriology.

The departments of agriculture and horticulture have each a separate equipment of land, buildings, laborers, teams and implements. The divisions of Entomology and Botany, and of Veterinary science have offices, laboratories and scientific apparatus, and have the use of such material or assistance in their work as the equipment of the farm and gardens affords.

The Director is the executive officer of the Station, acting as the representative of the Board of Control, and being responsible for its general plan of work. The associate officers are responsible for the execution of the general lines of work falling within their special departments. These officers will report briefly the general plan of their work for the year. The details of much of this work have been published in the issues of the Bulletin, the summary of which has been given.

In addition to the general superintendence of the work of the Station, I have given special attention during the past year to experiments in the use of chemical or commercial fertilizers, and to a study of wheat synonyms. In the experiments with fertilizers, the Station has had the co-operation of farmers in various parts of the State, whose tests, made on soils differing in character from that of the Station, add much to the value

of the results attained. These results will be published in an early issue of the Bulletin for 1890.

The study of wheat synonyms promises to yield results of great value to the farmer, and these will be published as soon as sufficient data have been accumulated to warrant the formulating of definite conclusions.

ACKNOWLEDGMENTS.

Through the courtesy of the publishers, the Station is receiving the following journals:

Agricultural Epitomist, Indianapolis, Ind.
American Analyst, New York City.
American Grange Bulletin, Cincinnati, O.
Baltimore Weekly Sun, Baltimore, Md.
Boston Weekly Globe, Boston, Mass.
Canadian Horticulturist, Toronto, Ont.
Colman's Rural World, St. Louis, Mo.
Dakota Farmer, Huron, Dak.
Farm and Fireside, Springfield, O.
Farm and Home, Springfield, Mass.
Farm, Field and Stockman, Chicago, Ill.
Farm Implement News, Chicago, Ill.
Farm, Stock and Home, Minneapolis, Minn.
Farmers' Advocate, London, Ont.
Farmers' Club Journal, Hornellsville, N. Y.
Farmers' Home, Dayton, Ohio.
Farmers' Review, Chicago, Ill.
Fruit and Grape Grower, Charlottesville, Va.
Holstein-Friesian Register, Brattleboro, Vt.
Home and Farm, Louisville, Ky.
Husbandman, Elmira, N. Y.
Journal of Agriculture, St. Louis, Mo.
Maritime Agriculturist, Sackville, N. B.
Microscope, The, Detroit, Mich.
Mirror and Farmer, Manchester, N. H.
Ohio State Journal, Columbus, O. (weekly ed).
Old Homestead, Cleveland, O.
Orange Judd Farmer, Chicago, Ill.
Orchard and Garden, Little Silver, N. J.
Pacific Rural Press, San Francisco, Cal.
Popular Gardening, Buffalo, N. Y.
Prairie Farmer, Chicago, Ill.
Press, The, New York City (weekly ed).
Press, The, Philadelphia, Pa. (weekly ed).
Rural and Poultry World, Syracuse, N. Y.
Southern Empire, Americus, Ga.
Sugar Beet, Philadelphia, Pa.
Vick's Illustrated Magazine, Rochester, N. Y.
Western Farmer, Sioux City, Iowa.
Western Resources, Lincoln, Neb.
World, The, New York City (weekly ed).

The Station is under obligations to the following individuals for the favors named:

James Barrett, Augusta, Ga. Seed peanuts.
J. F. Hawkins, New Lisbon, O. Seed wheat.
W. H. Hood, Lock, O. Seed wheat.
H. A. Marsh, Hidalgo, Wash. Horticultural seeds.
J. R. Reeves, Rome, O. Seed wheat.
H. J. Smith, Caledonia, O. Right to use patent fence.
A. G. Tillinghast, Padilla, Wash. Horticultural seeds.
Wm. Warder, Griffin, Ga. Horticultural seeds.
Jeff. D. Welborn, New Boston, Texas. Cotton seed.
D. M. Wolf, Dayton, O. Seed wheat.
G. Wright & Son, Hudson, Mich. Spraying pump.

Seeds have also been received from the Experiment Stations of Canada, California, Dakota, Kansas, Michigan, Texas and Wisconsin, for which thanks are returned.

In conclusion, it is my pleasant duty again to express my obligations to the members of the Board of Control on the one hand, and to my co-workers of the Station staff on the other, for their cordial support and hearty co-operation throughout the year.

Respectfully submitted.

CHARLES E. THORNE, *Director*.

To Hon. S. H. ELLIS, *President Board of Control*.

REPORT OF THE AGRICULTURIST.

During the year 1889 the Agricultural Department of the Station has followed the same lines of work pursued in 1888, with some additions. The several subjects of study and investigation may be included under the following heads:

- I. A comparison of the relative values of corn silage and field beets as foods for milch cows.
- II. Comparisons of varieties of wheat, oats, corn and field beets.
- III. The effect of commercial fertilizers upon quantity and quality of crops.
- IV. Variations in quantity and quality, as produced by different methods of planting and cultivation.
- V. Variation in reproduction resulting from selection of seed.
- VI. The effect upon the crop of planting at different dates.
- VII. Observations upon various forage crops.

Following the general plan as outlined above, the experiments conducted have been as follows:

A feeding experiment was begun about the 1st of March, with twelve grade Shorthorn cows, selected from a herd of thirty two. These twelve were divided into four groups of three each. A careful record was kept of food given each cow, of her daily weight and daily product of milk, and an analysis of each cow's milk was made by Short's method every two weeks during the experiment, which lasted over a period of eight weeks. Details and results of the experiment were published in Bulletin No. 3.

Wheat. 1. Sixty-five varieties were sown upon tenth-acre plots for a comparative test of yield, strength of straw and such other characteristics as might be developed. The following points were brought out by this experiment:

- (a.) The individual yields of the several varieties.
- (b.) The average yields of bearded as compared with smooth wheats.
- (c.) The average yields of white as compared with red wheats.

About 270 so-called varieties were sown in smaller plots, for the purpose of studying their botanical differences.

2. Eleven plots were sown with the same kind of wheat, varying in

amount from a rate of two pecks per acre up to nine pecks, some of which were duplicated.

3. Nine tenth-acre plots were given treatment exactly alike, except that they were drilled in, each one week later than the one preceding.

4. Ten plots were treated under different methods of cultivation and depths of seeding.

5. About eighty plots were devoted to experiments on the application and use of commercial and farm manures.

The results, with details of experiments in wheat, have been published in Bulletin No. 5, with the exception of the work in commercial and farm manures, which will be published in connection with other experiments with fertilizers.

A number of promising varieties of wheat were sent out to farmers of the State for testing, and will be reported upon in a future bulletin of the Station.

Oats. 1. Forty-six varieties of oats were drilled upon tenth-acre plots for comparative testing, several of which were duplicated.

2. A series of plots were drilled at different rates, varying from two pecks to fourteen pecks per acre; several of these were also duplicated to serve as checks.

3. Twenty-two tenth-acre plots were used for testing the utility of commercial manures on oats.

4. Several lots of oats were sent out over the State for trial upon different soils, results of which will be given in connection with our own work upon oats in a future bulletin.

Corn. 1. About fifty-two varieties of corn were planted for a comparative test, including the following classes: Large Yellow Dent, Medium Yellow Dent, Small Yellow Dent, Large White Dent, Yellow Flint, Large White Flint, Mixed Flint, Flour Corn and Ensilage Corn.

2. Experiments in methods of planting and culture of corn were carefully carried out under the following heads:

- (a.) Planting at different depths and upon different dates.
- (b.) Distribution of seed, including hill and drill planting, and placing grain at different distances in drills.
- (c.) Testing vitality of seed from different parts of the ear.
- (d.) Giving the crop different amounts of cultivation.
- (e.) Contrasting deep and shallow cultivation.

3. An experiment was made to test the effect of commercial fertilizers on corn, covering twenty-two tenth-acre plots.

Field Beets. Nearly three acres of land was devoted to a comparative

test of varieties of field beets, and of the effect of commercial manures upon the growing crop.

The results of experiments with corn and field beets will appear in a future publication of the Station.

During the past two years I have done some work on forage crops in a small way, studying them chiefly with a view to determining their adaptability to our soil and climate. Among these I may mention alfalfa or lucerne, lupins, seradella, teosinte and spurry.

Aside from superintending the foregoing work, I have spent considerable time looking after odd work, such as grading, repairing of roads, making repairs and changes about out-buildings, making sales of stock, seed wheat, oats and corn; also giving directions in the work of the dairy and looking after the interests of that department.

J. FREMONT HICKMAN,
Agriculturist.

REPORT OF THE HORTICULTURIST.

The work in the Horticultural Department of the Station for 1889 has been a continuation of that of 1888, and may be classed under the following heads:

- I. Comparisons of varieties and strains of varieties.
- II. Comparisons of effect of fertilizers upon crops, both upon quantity and quality of product.
- III. Comparisons of methods of planting and cultivation.
- IV. Comparisons of methods of treating seeds.
- V. Observations upon the effect of selection, as illustrated by strains of varieties.
- VI. Observations on the influence of soil and climate upon the growing of seeds as shown in vitality, vigor of plants produced and the resulting crops.
- VII. Experiments in ripening and keeping fruit.

Under this general plan, the following experiments have been made:

Potatoes. 120 varieties, both new and old, were on trial, nearly all of which were duplicated.

A special test of comparative earliness was carried on with a number of early varieties, the point to determine being which variety furnished the largest and most of marketable potatoes at any given early date.

A number of the most promising varieties were sent to growers in different parts of the State for trial.

A trial of fertilizers, including the more common forms of chemical manures singly and in various combinations.

A very full and careful test of different methods of cutting was conducted with eight varieties.

The results of the above trials are to be published in a special bulletin.

Celery. Nearly all varieties offered by seedsmen were on trial, some of which were duplicated, making 91 samples in all. This test is to be repeated and the results of both seasons published in a bulletin.

Beets. Forty-nine different samples were on trial for the purpose of determining relative market value.

Peas. A very full test of varieties was made, including 62 samples.

Cauliflower. Fifty-four different samples were tested, and the results published in Bulletin No. 7, volume II.

Cabbage. The test with this crop was to determine comparative earliness. The results have been given in the same bulletin as the one giving a report on cauliflower.

Onions. A very full test was made of the varieties of this vegetable, and several lots of seed were sent out to onion growers for trial.

Trials were also made with a large number of varieties of lettuce, sweet corn, tomatoes, parsnips, salsify, squashes, peppers, egg plants and turnips. The results of these tests will be published as soon as a sufficient number of trials have been made to render a report concerning them of permanent value.

Small fruits were reported upon in Bulletin No. 4, for July, 1889.

Particular attention has been devoted during the winter to the effect of climate upon seeds grown in different latitudes. Seeds have been procured from northern and southern latitudes, and vitality tests made in the greenhouse. The experiments are to be continued by outdoor plantings of as many varieties as it is practicable to grow.

Experiments in irrigation have been undertaken with special reference to the utilizing of small quantities of water on such crops as are most likely to suffer in time of drought.

Experiments in pruning are now in progress.

Crossing and hybridizing are to be undertaken the present season with several classes of plants. Some work of this kind was done during the winter in the greenhouse.

Experiments in methods of heating greenhouses are now in progress, and are to be continued.

W. J. GREEN, *Horticulturist.*

REPORT OF THE ENTOMOLOGIST AND BOTANIST.

Although the Division of Entomology and Botany of this Station, as at present constituted, was not organized until April 1, 1889, three months after the beginning of the current calendar year—when the Botanical Division was consolidated with that of Entomology—in the following outline of the years' work, I will not attempt to treat separately the entomological operations prior to the reorganization. As heretofore, the work of the Division has fallen into two distinct lines: (1.) Contributions to knowledge, either pure or applied; and (2.) Dissemination of information.

Among the more important published results of the work of the Division during the year, which can properly be classed under the first head, I may mention the following:

- (1.) The demonstration of the effectiveness of the arsenites as a remedy for the Plum Curculio.
- (2.) The demonstration of the uselessness of a number of methods commonly recommended to prevent the injuries of the Striped Cucumber Beetle, and of the effectiveness of others.
- (3.) Additions to our knowledge of the life-histories of a number of species of injurious plant-lice.
- (4.) Contributions to a knowledge of the life-histories of certain lady-bird beetles.
- (5.) Contributions to a knowledge of the life-histories and habits of a number of aquatic insects.
- (6.) A contribution to a knowledge of the bibliography of insects affecting clover.
- (7.) The demonstration of the feasibility of combining insecticides and fungicides for practical application.
- (8.) Experiments in preventing Potato Blight by the application of the Bordeaux mixture.
- (9.) Experiments in preventing the injuries of the Brown Rot of stone fruits by the application of copper compounds.
- (10.) The demonstration of the danger of using the Bordeaux mixture as a preventive of Apple Scab.
- (11.) Additional evidence concerning the value of copper compounds as a preventive of the Black Rot of grapes.
- (12.) Evidence that the Leaf Spot disease of the pear and quince may be prevented by the application of copper compounds.

Besides the above lines of work, the results of which have already been presented to the public, investigations and experiments have been

carried on with a number of other subjects which are yet in hand. Of the more important of these, I may mention an elaborate investigation of the feeding habits of frogs, toads and young birds; an investigation of the amount of heat certain seeds will endure without injury to their germinating qualities; studies on the larvæ of dragon flies; and special studies of various groups of insects and plants found in the State.

The work done by the Division in the second line—that of the dissemination of information—may be summarized as follows.

- (1.) The answering of more than six hundred letters of inquiry concerning insects and plants.
- (2.) The publication of ten articles, averaging ten pages each, in the Bulletin of the Station; and one circular on the Grain Plant-louse.
- (3.) The publication of about thirty articles in leading agricultural and horticultural journals.
- (4.) The delivering of twenty addresses before farmers' institutes and horticultural societies.

Considerable additions have been made to the working equipment of the Division in the way of collections of insects and plants. Insects especially, have been collected, not only in this region, but also in at least six other counties in widely separated portions of the State. The work in these lines may be approximately summarized as follows:

- (1.) The building up of a herbarium of five hundred species, together with duplicates to the extent of 1,500 specimens.
- (2.) Large additions to the reference collection of determined insects.
- (3.) Additions to the miscellaneous insect collections of about 10,000 pinned specimens, and 5,000 preserved in alcohol.
- (4.) A considerable collection of Ohio shells.

During the last half of year I have had the efficient assistance of Miss Freda Detmers, whose skill and patience have been of great value in the preparation of engravings, and the general botanical work. In the formation of collections and conducting of experiments, I have been assisted by certain University students, who have devoted their spare hours to the work. Of these, especial mention should be made of Messrs. H. H. Richardson, F. W. Rane and H. A. Surface. And, finally, I have to thank the Director and my colleagues, for the cordial co-operation which has so greatly aided the carrying on of the season's work.

CLARENCE M. WEED,
Entomologist and Botanist.

REPORT OF THE VETERINARIAN AND BACTERIOLOGIST.

My principal work of the past year, concerning the etiology of swine-plague, or so-called hog-choleera, is, owing to several causes over which I had no control, not yet completed. In the first place, the nature of this work, and the many difficulties to be overcome, permit but slow progress; and secondly, material for experimentation was scarce, and many times, could not be obtained when needed. Hence it may yet be some time before I can hand in a final report and publish the results of my experiments in a bulletin.

Last year I wrote one bulletin, a double number, for April and May, on colic of horses and its most frequent causes. As is self-evident, this bulletin contains a great deal that is not new, or that was not unknown, but it also contains facts which, although perhaps partially known to a few, were entirely unknown to a majority of our farmers and live-stock men, the very class of people for whom the bulletins of the Station are intended. These facts, originally discovered by Professor Bollinger in Munich, were corroborated and confirmed by the investigations of the writer. As these investigations have been, and are yet, continued, I am at liberty to state that the correctness of the statements in the above mentioned bulletin in regard to the frequency of aneurysms, caused by *Sclerostomum equinum*, in the anterior mesenteric artery and in other branches of the posterior aorta of horses, and their causal connection with attacks of colic, finds constant corroboration. The investigation, as already mentioned, is not only continued but also extended to the life history of that entozoön (*Sclerostomum equinum*). The investigation was begun and the bulletin was written for the purpose of putting the treatment of colic upon a more rational basis, and of thus preventing the heavy losses which are caused every year, not by the disease, but by the irrational treatment so frequently applied. It is extended to the life history of the entozoön with the object in view that a better knowledge of the same may afford a basis for rational means of prevention.

It seems the bulletin was appreciated, for the demand for it was such that the whole issue of 12,000 copies was soon exhausted, and that numerous later demands could not be complied with. Favorable com-

ments and extracts, more or less lengthy, have been published by most of the leading agricultural papers, and a prominent live stock journal, giving due credit, has published it in full.

As other work, I may mention an examination and investigation of epizootic and enzootic diseases of live stock, requiring journeys to several parts of the State, but as nearly all of them were only of local importance, or not of a malignant character, it was not deemed necessary to report in a special bulletin. Of one of these diseases, a few cases of slavering in horses, in the southwestern part of the State, caused by the feeding of damaged clover hay, the investigation is not yet completed, but will be in a short time, and if the result is deemed of sufficient importance, the same will be published in my next bulletin.

At present I am preparing an atlas of pathogenic (disease-producing) bacteria. The plates on which the latter will be represented, exactly 800 diameters enlarged by mechanical reproductions from photographs, will be thirty-six or forty in number. If the latter number is reached a few animal parasites, such as trichinæ and some other small entozoa, magnified from forty to eighty diameters, will be added. The photographic illustrations, two on each plate, will be explained by a brief description, so that each plate will have about one page text. The negatives are nearly all finished. This bulletin, of course will be of a scientific character, and I flatter myself will be of great value to physicians, veterinarians, health officers, naturalists, and all intelligent persons who take interest in a study of the nature of infectious diseases. It will show and explain the causes of these diseases, and thus prevent irrational treatment, and quackery in general, not only where an infectious disease has broken out, but also where protection against it is intended. Some pathogenic bacteria, such as undergo different stages of development, or present important differences in different media, for instance in animal tissues and in artificial culture media, will be represented in their various phases of development.

H. J. DETMERS, M. V. D., *Veterinarian*.

REPORT OF THE METEOROLOGIST.

The year has been marked by the absence of extremes of temperatures, by uniformity of distribution in rainfall, and unusually high average temperature during the last month. Although the total rainfall for the year is over nine inches below the Station average, it has been so well distributed, that crops have suffered but little from drought. There was a deficiency of rain in February; also a short drought during the last of April and the first part of May, which was somewhat injurious to growing crops at that critical stage of their development. Aside from these periods, no serious injury to crops was occasioned by drought, and at no time were the conditions rendered unfavorable by a superabundance of rainfall. These facts should be noted in connection with the heavier rainfall of other years, for instance that of 1887, which was more than seven inches above that of 1889, yet during that year crops suffered severely from drought.

The high temperature during December has naturally been attended by an unusual growth of vegetation. Wheat is very far advanced, many wild and cultivated flowering plants have been observed in bloom, and in some instances the buds of our fruit trees have reached a stage of development which admits of injury in case of severe cold weather.

As a whole, the weather of the year has been favorable for growing crops, as has been proved by the abundant harvest.

The following tables contain statistics of rainfall, temperature, etc., for the year:

EXPLANATION OF TABLES.

Table I shows the daily rainfall at the Station during the year in hundredths of an inch.

T stands for "trace," an amount too small to measure.

Table II shows the daily mean temperature for the same period.

Table III gives a comparison of the temperature and rainfall at the Station, with the seven-year average for the Station and also with the seven-year average of the State.

with the rainfall and prevailing direction of wind for both the Experiment Station and State.

Table IV contains the record of atmospheric pressure; the mean temperature; the highest and lowest temperature with the range of temperature for each month; the number of clear, fair, cloudy and rainy days;

Table V shows the rainfall at the Station for each month during the last seven years.

Table VI contains the principal points of interest on the temperature, state of weather, and rainfall during the same period.

Table VII is a summary of Table VI.

METEOROLOGY.—TABLE I—DAILY RAINFALL AT THE OHIO EXPERIMENT STATION FOR 1889.

	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.....		T	.24	.19		.02	T			.05		
2.....			.03				.01	.72	T		.19	
3.....		.09	T	.07			.67	T	.17	.04		T
4.....						.22	T	.53	.02			.03
5.....	1.13	.02		.04				.06	.79			
6.....	.02	.03							.10			
7.....			.03			.22					.04	T
8.....	.05	.07	.06			.31					.89	.12
9.....	.36	.02				T		.10			.01	
10.....			T			T	T	.51			T	1.26
11.....		.05		.03	.31		T					.03
12.....				.38						.02		
13.....		.12			.13		.17	T		.08	.45	
14.....	.08				.07	.09	.93	.05			.01	.07
15.....		.03				.10	.01		.83			
16.....	.86	.28				.18		.04	.83			T
17.....		T				T			.19		.44	
18.....		.10	.24			.09	.37				.01	.17
19.....			.11		.74	.10	.04				.48	
20.....	.53		.10	.02	.16	T	.35		.09		.20	.17
21.....	.01				.01	T		.04			.06	
22.....			T		.19					.51	.07	.33
23.....					.02					.01		
24.....	.05			.38	.16						.13	
25.....					.01	.36			.28	.48	.16	T
26.....	.03					.12			.01	.34	.40	.06
27.....	.76	T	T	T	.10	.13				.04	.12	
28.....	.02					.10	.24				.03	
29.....			.11		.53	.03	(04)		T		.03	T
30.....					.90	.01			.46	T		
31.....			.08		.13					.22		
Total for month.....	3.90	.81	1.00	1.11	3.46	2.08	2.85	2.07	3.77	1.79	3.72	2.24
Av. daily rainfall...	0.126	0.029	0.032	0.037	0.111	0.069	0.092	0.067	0.126	0.058	0.124	0.072

METEOROLOGY.—TABLE II.—DAILY MEAN TEMPERATURE AT THE OHIO EXPERIMENT STATION FOR 1889.

	Jan.	Feb.	Mar.	Apr.	May	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.....	33.5	25.5	38.6	40.4	46.0	48.8	77.0	73.2	74.8	59.8	59.8	32.2
2.....	31.9	31.2	36.7	53.2	42.8	57.6	78.2	72.0	70.8	50.8	62.9	41.6
3.....	33.2	31.8	37.8	48.5	47.8	62.0	74.5	70.2	70.8	56.5	42.2	37.2
4.....	33.2	39.9	36.9	40.8	55.6	54.5	67.0	68.8	70.0	46.8	41.2	30.4
5.....	37.5	22.2	34.4	34.2	60.8	58.1	66.0	66.8	72.2	49.8	32.8	42.5
6.....	35.2	11.0	36.8	33.9	64.9	60.8	70.2	64.0	62.5	41.2	33.5	34.8
7.....	33.4	18.0	33.0	44.9	69.2	64.8	75.2	65.2	60.5	34.8	40.5	41.5
8.....	39.6	30.1	35.2	45.1	73.5	69.8	80.0	70.0	66.5	40.2	48.0	58.2
9.....	35.5	24.5	27.4	50.4	77.5	72.8	80.5	74.0	69.5	47.2	44.6	42.5
10.....	30.2	30.2	30.8	51.8	79.9	66.2	79.2	68.0	70.5	49.5	42.8	52.0
11.....	33.0	26.8	32.2	54.2	69.8	64.5	77.0	65.2	69.0	61.2	41.2	42.8
12.....	32.2	45.8	43.8	62.5	66.8	68.2	78.0	64.0	68.8	58.0	47.8	46.5
13.....	34.2	16.9	46.5	43.0	61.9	69.8	77.2	70.2	69.8	46.5	53.2	48.5
14.....	32.3	26.6	48.0	46.9	59.2	72.0	74.3	71.5	69.8	43.0	41.2	45.8
15.....	39.4	36.4	51.6	52.8	63.5	71.8	65.5	61.0	73.5	46.5	33.4	36.4
16.....	52.0	52.8	49.8	51.6	72.8	72.5	67.5	64.0	62.2	49.0	32.6	46.4
17.....	36.2	35.2	55.3	57.9	76.2	73.8	72.5	65.0	56.8	54.5	37.8	56.5
18.....	24.0	25.4	51.6	65.5	77.4	73.5	73.5	66.8	51.8	46.2	41.1	45.5
19.....	26.0	16.6	44.0	70.0	62.0	76.8	75.8	69.5	53.8	52.0	39.6	47.8
20.....	33.5	15.8	.....	60.0	59.0	74.2	70.5	74.5	51.8	47.0	45.4	50.5
21.....	21.0	31.8	.....	55.8	48.8	67.8	70.0	70.8	47.0	46.2	43.8	45.1
22.....	30.4	27.0	41.8	46.4	45.8	60.8	74.8	64.8	52.5	42.5	39.1	40.5
23.....	39.2	4.9	43.0	62.6	51.8	64.2	71.5	66.5	56.8	38.8	38.0	36.2
24.....	37.6	11.8	48.1	61.5	62.8	67.8	70.0	69.2	62.8	40.8	52.8	56.2
25.....	37.1	23.1	36.0	46.2	54.8	62.5	69.8	70.0	64.2	48.2	34.1	57.0
26.....	39.6	37.1	43.5	46.0	56.2	66.8	72.5	70.5	51.8	46.8	36.4	43.0
27.....	31.1	36.0	50.5	52.8	56.4	69.8	75.5	67.0	48.2	41.0	42.2	36.6
28.....	22.8	35.4	36.8	48.5	55.4	73.2	73.2	70.0	57.2	36.8	27.2	44.8
29.....	20.5	.....	34.8	48.5	54.8	73.5	69.2	70.8	59.2	41.2	23.2	49.8
30.....	28.8	.....	35.5	46.1	55.8	73.5	68.5	72.5	59.2	47.2	23.2	27.8
31.....	28.6	.....	56.2	.....	46.8	.....	70.0	76.2	.....	51.0	.....	34.4
Mean for month.	33.0	26.4	41.3 ^a	50.7	60.6	67.1	73.0	68.8	62.6	47.1	40.7	43.6

* Error on account of readings for 20th and 21st being omitted.

METEOROLOGY—TABLE III—COMPARISON OF MEAN TEMPERATURE, MEAN RELATIVE HUMIDITY, AND RAINFALL FOR 1889.

	Jan.	Feb.	Mar.	April	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	
Mean temperature at the Station.....	33.0°	26.4°	41.3°	50.7°	60.6°	67.1°	73.0°	68.8°	62.6°	47.1°	40.7°	43.6°	51.2°
Mean relative humidity at the Station.....	88.4%	87.3%	77.7%	72.4%	73.4%	82.0%	78.1%	75.5%	79.0%	77.1%	85.7%	80.4%	79.8%
Seven-year average temperature at the Station	24.0°	28.5°	35.8°	49.1°	61.5°	69.0°	73.3°	69.8°	63.5°	48.4°	39.7°	31.7°	49.5°
Seven-year average humidity at the Station.....													81.9%
Mean temperature for the State	33.3°	25.8°	40.2°	49.9°	60.2°	66.7°	72.5°	69.1°	62.9°	47.9°	41.0°	43.8°	51.1°
Mean relative humidity for the State	83.5%	82.5%	76.5%	73.4%	74.1%	81.8%	79.6%	75.5%	80.1%	79.0%	85.6%	80.9%	79.4%
Seven-year average temperature for the State.....	24.8°	28.8°	35.6°	49.5°	60.9°	69.0°	73.3°	69.9°	63.8°	51.1°	40.7°	32.3°	50.0°
Seven-year average humidity for the State.....	82.4%	82.3%	77.9%	72.4%	73.5%	76.1%	74.4%	75.3%	76.3%	77.4%	79.1%	81.3%	77.4%
	<i>Inches.</i>	<i>Inches.</i>	<i>Inches.</i>	<i>Inches.</i>	<i>Inches.</i>	<i>Inches.</i>	<i>Inches.</i>	<i>Inches.</i>	<i>Inches.</i>	<i>Inches.</i>	<i>Inches.</i>	<i>Inches.</i>	<i>Inches.</i>
Rainfall at the Station	3.90	0.81	1.00	1.11	3.46	2.08	2.85	2.07	3.77	1.79	3.72	2.24	23.80
Seven-year average at the Station	3.51	3.61	2.71	2.89	5.35	3.26	2.87	2.82	2.76	2.49	3.27	2.51	38.05
Mean rainfall for the State.....	3.13	1.35	1.50	1.79	3.71	4.13	4.25	1.50	3.62	1.78	4.02	2.81	33.53
Seven-year average for the State.....	3.13	3.64	2.37	2.67	4.09	3.75	3.57	3.18	3.00	2.55	3.10	2.58	38.11

* Small error on account of the omission of reading for March 21, 1889.

METEOROLOGY.—TABLE IV.—SUMMARY BY MONTHS FOR 1889.

Month.	Barometer.						Mean relative humidity.			
	Mean.	Highest.	Date.	Lowest.	Date.	Range.		Mean.	Highest.	Date.
AT THE EXPERIMENT STATION.										
January.....	30.056	30.498	19th.	29.176	9th.	1.322	88.4	33.0	56.	*1
February.....	30.173	30.793	23d.	29.451	4th.	1.342	87.3	26.4	62.	16th.
March.....	†29.986	30.484	30th.	29.608	7th.	8.26	†77.7	†41.3	74.5	17th.
April.....	30.039	30.336	7th.	29.511	27th.	1.025	72.4	50.7	82.	19th.
May.....	29.967	30.291	5th.	29.088	30th.	.683	73.4	60.6	91.	10th.
June.....	30.011	30.396	24th.	29.735	18th.	.661	82.0	67.1	85.	*4
July.....	29.976	30.235	6th.	29.682	19th.	.553	78.1	73.0	92.	*5
August.....	30.118	30.354	27th.	29.763	14th.	.491	75.5	68.8	93.	31st.
September.....	30.042	30.344	27th.	29.546	20th.	.798	79.0	62.6	93.	1st.
October.....	30.116	30.385	23d.	29.696	25th.	.689	77.1	47.1	79.	11th.
November.....	30.085	30.640	16th.	29.165	21st.	1.175	85.7	40.7	66.	1st.
December.....	30.135	30.608	30th.	29.651	29th.	.952	80.4	43.6	67.	29th.
Average.....	30.058	30.793	Feb. 23	29.176	Jan. 9.	1.617	79.8	51.2	93.	*15
FOR THE STATE.										
January.....	30.049	30.569	19th.	29.009	9th.	1.566	83.5	33.3	61.0	23d.
February.....	30.168	30.858	23d.	29.160	4th.	1.498	82.5	25.8	69.8	16th.
March.....	29.917	30.517	1st.	29.500	7th.	1.017	76.5	40.2	81.5	17th.
April.....	30.015	30.598	7th.	29.426	28th.	1.172	73.4	49.9	88.0	19th.
May.....	29.965	30.350	5th.	29.526	30th.	.824	74.1	60.2	96.0	10th.
June.....	30.007	30.462	24th.	29.664	19th.	.798	81.8	66.7	92.2	29th.
July.....	29.979	30.260	6th.	29.607	19th.	.673	79.6	72.5	98.0	9th.
August.....	30.087	30.389	27th.	29.664	14th.	.675	75.5	69.1	99.5	31st.
September.....	30.048	30.401	27th.	29.435	20th.	.966	80.1	62.9	98.5	1st.
October.....	30.114	30.521	23d.	29.590	1st.	.931	79.0	47.9	82.0	11th.
November.....	30.107	30.677	16th.	29.395	22d.	1.292	85.6	41.0	77.0	1st.
December.....	30.139	30.686	1st.	29.469	29th.	1.217	80.9	43.8	73.0	10th.
Average.....	30.056	30.858	Feb. 23	29.009	Jan. 9.	1.849	79.4	51.1	99.5	Aug. 31

*1—16th and 17th. *2—22d and 30th. †Error on account of the omission of reading for 21st. *3—*8—2d and 5th. *9—8th and 22d. *10—26th, 27th and 28th. *11—2d, 10th and 21st. *12—1st and January 6th, November 20th.

METEOROLOGY.—TABLE IV.—SUMMARY BY MONTHS FOR 1889.

Temperature.								No. of days.				Monthly rainfall.	Average daily rainfall.	Prevailing wind.
Lowest.	Date.	Monthly range.	Mean daily range.	Greatest daily range.	Date.	Least daily range.	Date.	Clear.	Fair.	Cloudy.	Rain fell.			
16.	*2.	40.	15.9	29.	12th.	3.	6th.	5	9	17	13	3.90	0.126	S. W.
1.	23d	61.	17.3	31.	5th.	5.3	3d.	8	8	12	14	.81	0.029	S. W.
17.	11th.	57.5	↑22.0	41.	17th.	15.3	10th.	↑11	↑6	↑13	13	1.00	0.032	N. W.
21.	6th.	61	23.6	41.5	23d.	9.5	4th.	12	10	8	8	1.11	0.037	N. E.
31.5	1st.	59.5	24.1	40.	3.	10.	31st.	8	16	7	14	3.46	0.111	S. W.
42.	1st.	43.	19.1	29.	6th.	9.	1st.	5	13	12	20	2.08	0.069	S. W.
49.	16th.	43.	22.9	31.	6.	13.	7.	11	13	7	14	2.85	0.092	S. W.
40.	15th.	53.	26.9	39.	31st.	14.	8.	20	7	4	10	2.07	0.067	N. W.
31.	22d.	62.	23.8	36.	9.	7.	30th.	14	8	8	13	3.77	0.126	S.
22.	8th.	57.	21.1	41.	11th.	7.	10.	14	8	11	11	1.79	0.058	N.
21.	30th.	45.	15.4	33.	12th.	3.	20th.	5	8	17	19	3.72	0.124	W.
17.	1st.	50.	20.6	33.	24th.	9.	14.	11	10	10	14	2.24	0.072	S.
1.0	Feb. 23.	92.	↑21.1	41.5	Apr. 23.	3.	16.	124	113	128	163	28.80	0.079	S. W.
8.	29th.	60.2	15.2	49.0	23d.	1.0	5th.	6.9	7.9	16.2	11.0	3.13	0.101	W.
13.5	24th.	83.3	17.5	43.0	21st.	2.0	5th.	5.3	9.3	13.4	8.8	1.35	0.048	W.
10.3	30th.	71.2	19.4	53.0	30th.	2.0	11.	10.2	8.6	12.2	7.2	1.50	0.050	N. W.
15.0	6th.	73.0	21.9	48.0	23d.	3.0	27th.	9.9	10.0	10.1	5.3	1.79	0.060	N.
25.6	1st.	70.4	21.0	50.0	9th.	3.9	30th.	9.0	12.7	9.3	10.3	3.71	0.120	S. W.
38.0	12.	54.2	13.6	39.5	9th.	4.5	1st.	4.4	13.2	12.4	14.4	4.13	0.138	S. W.
46.5	25th.	51.5	20.3	40.	9th.	5.0	24th.	12.5	11.3	7.2	10.5	4.25	0.137	S. W.
40.0	15th.	59.5	23.3	41.4	30th.	5.5	9th.	17.9	7.6	5.5	5.4	1.50	0.049	S. W.
27.6	22d.	70.9	21.1	46.5	24th.	4.0	13.	12.4	9.3	8.3	9.3	3.62	0.121	S.
17.1	24th.	64.9	19.4	45.0	11th.	2.5	26th.	10.8	7.3	13.3	7.1	1.73	0.053	N.
8.6	30th.	63.4	15.0	38.5	12th.	2.0	22d.	4.9	6.5	13.6	14.1	4.02	0.134	W.
10.0	1st.	63.0	19.1	38.9	2d.	2.0	15th.	8.6	9.5	12.9	11.4	2.81	0.091	S. W.
-13.5	Feb. 24.	113.	19.3	53.0	Mar. 30.	1.0	Jan. 5.	112.8	113.8	133.4	114.8	33.53	0.092	S. W.

6th and 7th. *4—16th and 29th. *5—8th, 9th and 10th. *6—7th, 8th and 16th. *7—5th, 20th and 29th.
 4th. *13—16th, 17th, 20th and 30th. *14—4th and 25th. *15—August 31st, September 1st. *16—

METEOROLOGY.—TABLE—V.—MONTHLY RAINFALL AT THE EXPERIMENT STATION FOR SEVEN YEARS.

Year.	Jan.	Feb.	March.	April.	May.	June.	July.	August.	Sept.	Oct.	Nov.	Dec.	Total.
	<i>Inches.</i>	<i>Inches.</i>	<i>Inches.</i>	<i>Inches.</i>	<i>Inches.</i>	<i>Inches.</i>	<i>Inches.</i>	<i>Inches.</i>	<i>Inches.</i>	<i>Inches.</i>	<i>Inches.</i>	<i>Inches.</i>	<i>Inches.</i>
1883.....	2.90	5.81	2.87	2.98	5.76	4.70	2.92	2.12	3.13	4.34	3.87	4.97	46.37
1884.....	2.77	5.29	4.10	2.40	4.34	1.11	2.23	0.45	4.23	1.49	1.13	3.87	33.41
1885.....	4.03	3.17	0.98	4.51	5.92	4.84	3.01	5.50	2.00	3.12	2.89	1.68	41.65
1886.....	4.49	1.67	2.83	3.25	6.91	2.23	3.01	1.42	3.42	1.19	4.18	3.41	38.01
1887.....	1.54	6.85	2.84	4.45	4.36	5.47	1.56	2.47	1.82	0.38	2.64	2.04	36.62
1888.....	4.04	1.71	4.33	2.39	6.67	2.43	4.72	5.85	1.26	5.14	4.30	1.36	44.20
1889.....	3.90	0.81	1.00	1.11	3.46	2.08	2.85	2.07	3.77	1.79	3.72	2.24	28.80
Average.....	3.38	3.62	2.71	3.01	5.35	3.27	2.90	2.84	2.80	2.49	3.25	2.80	38.44

METEOROLOGY.—TABLE VI.—SUMMARIES* OF TEMPERATURE AND RAINFALL FOR SEVEN YEARS.

	1883.	1884.	1885.	1886.	1887.	1888.	1889.
<i>At the Experiment Station.</i>							
Mean relative humidity.....	82.3 per cent.....	82.3 per cent.....	84.2 per cent.....	82.7 per cent.....	79.2 per cent.....	82.8 per cent.....	79.8 per cent.
Mean temperature.....	49.1°.....	50.1°.....	47.4°.....	49.2°.....	50.8°.....	49.6°.....	51.2°.....
Highest temperature.....	97.0°, August 22.....	97.0°, August 20.....	101.0°, July 21.....	97.5°, June 4.....	102.5°, July 17.....	98.0°, June 20.....	98.0°, Aug. 31. and Sept. 1.
Lowest temperature.....	—7.0°, January 12.....	—32.0°, Jan. 25.....	—20.0°, Feb. 21.....	—12.0°, Feb. 17.....	—10.0°, Jan. 11.....	—11.0°, Jan. 23.....	1.0°, February 23.
Range of temperature.....	104.4°.....	129.0°.....	121.0°.....	109.5°.....	112.5°.....	109.0°.....	92.0°.....
Mean daily range of Temp... ..	22.9°.....	24.8°.....	23.1°.....	23.6°.....	24.1°.....	21.1°.....	20.8°.....
Greatest daily range of Temp	46.5°, September 11.....	49.5°, July 22.....	55.0°, Feb. 2.....	48.0°, Feb. 17.....	47.5°, Sept. 5.....	43.2°, April 28.....	41.5°, April 23.
Least daily range of Temp... ..	1.8°, January 23.....	4.0°, Feb. 25.....	4.0°, Dec. 10.....	5.0°, Feb. 7.....	3.0°, Dec. 12.....	4.1°, Aug. 21.....	3.0°, Jan. 6, and Nov. 20.
Number of clear days.....	105.....	103.....	83.....	107.....	98.....	96.....	124.....
Number of fair days.....	147.....	119.....	137.....	145.....	130.....	141.....	113.....
Number of cloudy days.....	113.....	144.....	146.....	113.....	137.....	129.....	128.....
Number of days rain fell.....	165.....	149.....	166.....	154.....	158.....	142.....	163.....
Total rainfall.....	46.37 inches.....	33.40 inches.....	41.65 inches.....	38.01 inches.....	36.62 inches.....	44.20 inches.....	28.80 inches.
Mean daily rainfall.....	0.127 inch.....	0.091 inch.....	0.114 inch.....	0.104 inch.....	0.100 inch.....	0.120 inch.....	0.079 inch.
Greatest monthly rainfall....	5.81 inches, Feb.....	5.29 inches, Feb.....	6.91 inches, May.....	6.85 inches, Feb.....	6.85 inches, May.....	6.67 inches, May.....	3.90 inches in January.
Least monthly rainfall.....	2.12 inches, Aug.....	0.45 inch, Aug.....	0.98 inch, March.....	1.19 inches, Oct.....	0.38 inch, Oct.....	1.26 inches, Sept.....	0.81 inch in February.
Warmest day of year.....	82.7°, July 23.....	80.5°, July 23.....	85.8°, July 31.....	81.9°, July 29.....	87.0°, July 17.....	84.1°, June 20.....	80.5°, July 9.
Coldest day of year.....	1.0°, January 22.....	—16.3°, Feb. 6.....	—4.0°, Feb. 10.....	—5.05°, Jan. 10.....	0.6°, Jan. 10.....	7.5°, Feb. 9.....	4.5°, February 23
Prevailing direction of wind	N. W.....	S. W.....	S. W.....	S. W.....	S. W.....	S. W.....	S. W.....
<i>For the State.</i>							
Mean relative humidity.....	76.3 per cent.....	76.3 per cent.....	77.5 per cent.....	77.8 per cent.....	75.8 per cent.....	78.2 per cent.....	79.4 per cent.
Mean temperature.....	49.4°.....	50.6°.....	48.0°.....	49.6°.....	51.4°.....	49.5°.....	51.1°.....
Highest temperature.....	98.8°, August 22.....	99.0°, Sept. 28, and Oct. 1.....	101.0°, July 21.....	98.6°, July 7.....	108.0°, July 18.....	102.0°, Jan. 27.....	99.5°, August 31.
Lowest temperature.....	—17.2°, Jan. 22.....	—34.0°, Jan. 25.....	—31.0°, Jan. 29.....	—21.5°, Jan. 12.....	—21.0°, Jan. 7.....	—15.0°, Jan. 27.....	—13.5°, February 24.
Range of temperature.....	115.5°.....	133.0°.....	132.0°.....	120.1°.....	129.0°.....	117.5°.....	113.0°.....
Mean daily range of Temp... ..	19.8°.....	20.5°.....	20.1°.....	20.2°.....	21.2°.....	19.6°.....	19.3°.....
Greatest daily range of Temp	55.2°, March 13.....	50.0° Sept. 5 and Dec. 4.....	53.5°, Jan. 30.....	57.0°, Dec. 11.....	57.0°, April 11.....	50.0°.....	53.0°, March 30.
Least daily range of Temp... ..	0.5°, December 23, ...	1.1°, Feb. 6.....	1.0° April 18 and Dec. 31.....	1.1°, March 27.....	1.0° Jan. 15 and April 16.....	1.2°, Jan. 16.....	1.0°, January 5.
Number of clear days.....	98.2.....	116.7.....	103.5.....	113.4.....	113.8.....	108.7.....	112.8.....
Number of fair days.....	135.4.....	118.3.....	132.8.....	125.7.....	127.3.....	123.4.....	113.8.....
Number of cloudy days.....	130.4.....	131.1.....	128.2.....	121.0.....	123.9.....	133.9.....	138.4.....
Number of days rain fell.....	146.0.....	145.0.....	147.7.....	130.7.....	120.9.....	124.7.....	114.8.....
Mean yearly rainfall.....	44.98 inches.....	40.19 inches.....	38.08 inches.....	36.71 inches.....	33.63 inches.....	39.64 inches.....	33.53 inches.
Mean daily rainfall.....	0.123 inch.....	0.110 inch.....	0.104 inch.....	0.100 inch.....	0.092 inch.....	0.108 inch.....	0.092 inch.
Prevailing direction of wind	S. W.....	S. W.....	S. W.....	S. W.....	S. W.....	S. W.....	S. W.....

METEOROLOGY—TABLE VII—GRAND SUMMARY OF TEMPERATURE AND RAIN-FALL FOR SEVEN YEARS.

At the Experiment Station.

Mean relative humidity, 81.9 per cent.
Mean temperature, 49.5°.
Highest temperature, 102.5°, July 17, 1887.
Lowest temperature, —32°, Jan. 25, 1884.
Range of temperature, 134.5°.
Mean daily range of temperature, 22.9°.
Greatest daily range of temperature, 55°, Feb. 2, 1885.
Least daily range of temperature, 1.8°, Jan. 28, 1883.
Average number of clear days, 102.2.
Average number of fair days, 133.1.
Average number of cloudy days, 129.8.
Average number of days on which rain fell, 156.1.
Average yearly rainfall, 38.43.
Mean daily rainfall, 0.105.
Greatest monthly rainfall, 6.91 inches, in May, 1886.
Least monthly rainfall, 0.38 inches, in Oct., 1887.
Warmest day, 87°, July 18, 1887.
Coldest day, —16.8°, Feb. 6, 1884.
Prevailing direction of wind, southwest.

For the State.

Mean relative humidity, 77.4 per cent.
Mean temperature, 50°.
Highest temperature, 108°, July 18, 1887.
Lowest temperature, —34°, Jan. 25, 1884.
Range of temperature, 142°.
Mean daily range of temperature, 20.2°.
Greatest daily range of temperature, 58.5°, Jan. 30, 1885.
Least daily range of temperature, 0.5°, Dec. 23, 1883.
Average number of clear days, 110.3.
Average number of fair days, 125.2.
Average number of cloudy days, 129.5.
Average number of days rain fell, 132.8.
Mean yearly rainfall, 38.11 inches.
Mean daily rainfall, 0.104 inches.
Prevailing direction of wind, southwest.

NOTES ON THE WEATHER AT THE STATION.

SUMMARY BY MONTHS.

January.

The mean barometer was 30.056. The highest barometer, 30.498, occurred on the 19th; the lowest, 29.176, on the 9th.

The mean relative humidity was 83.4 per cent.

The mean temperature was 33°; the highest temperature, 56°, on the 16th and 17th; and the lowest, 16°, on the 22d and 30th.

Cloudy weather prevailed; rain fell on 10 days, and snow on 6.

The total snowfall was 5 inches, and the total rain and melted snow 3.90 inches. The heaviest rainfall was 1.13 inches on the 5th.

Solar halos were observed on the 15th, 19th and 22d. A lunar halo was seen on the 19th.

The prevailing direction of the wind was southwest.

February.

The mean barometer was 30.173. The highest barometer, 30.793, occurred on the 23d; and the lowest, 29.451, on the 4th.

The mean relative humidity was 87.3 per cent.

The mean temperature was 26.4°; the highest temperature, 62°, on the 16th; and the lowest, 1°, on the 23d.

Eight days were clear, 8 fair, and 12 cloudy.

Rain fell on 6 days and snow on 9. The total snowfall was 3½ inches, and the total rain and melted snow amounted to 0.81 inch, or 2.81 inches below the Station average for February. The heaviest rainfall, 0.28 inch, occurred on the 16th.

Solar halos were observed on the 7th, 10th, 21st and 25th, a lunar halo on the 7th.

The prevailing wind was southwest.

March.

The mean barometer was 29.986. The highest barometer, 30.434, occurred on the 30th; the lowest, 29.608, on the 7th.

The mean relative humidity was 77.7 per cent.

The mean temperature was 41.3°; the highest, 74.5°, on the 17th; and the lowest, 17°, on the 11th.

Eleven days were clear, 6 fair, and 14 cloudy.

Rain fell on 9 days, and snow on 6. The total snowfall amounted to 1 inch, and the total rain and melted snow to 1.00 inches, or about 2 inches below the Station average. The heaviest rainfall was 0.24 inch, on the 1st and 18th.

Solar halos were observed on the 15th, 16th and 24th; and a lunar halo on the 16th.

Frosts occurred on the following dates, viz.: the 4th, 6th, 7th, 8th, 9th, 11th, 12th, 13th, 14th, 16th, 17th, 23d, 24th, 26th, 29th and 30th.

Hail occurred on the 1st.

The prevailing wind was northwest.

April.

The mean barometer was 30.039. The highest barometer, 30.536, occurred on the 7th; the lowest, 29.511, on the 27th.

The mean relative humidity was 72.4 per cent.

The mean temperature was 50.7°; the highest, 82°, on the 19th; and the lowest, 21°, on the 6th.

Twelve days were clear, 10 fair, and 8 cloudy.

Rain fell on 8 days and snow on 1. The total snowfall was less than 1 inch; while the total rain and melted snow was 1.11 inches, or 1.90 inches below the Station average. The heaviest daily rainfall occurred on the 12th and 24th, being in each case 0.38 inch.

Solar halos were observed on the 14th, 15th and 19th; a lunar halo on the 14th.

Frosts occurred on the 5th, 7th, 8th, 10th, 14th, 16th, 22d and 23d.

The northeast wind prevailed.

May.

The mean barometer was 29.967. The highest barometer, 30.291, occurred on the 5th; the lowest, 29.608, on the 30th.

The mean relative humidity was 73.4 per cent.

The mean temperature was 60.6°; the highest temperature, 91°, on the 10th; the lowest, 31.5°, on the 1st.

Fair weather prevailed, but rain fell on 14 days.

The total rainfall amounted to 3.46 inches, which is 1.89 inches below the Station average. The heaviest rains were 0.74 inch on the 19th, 0.53 inch on the 29th, and 0.90 inch on the 30th.

Solar halos were observed on the 6th, 9th and 26th; and a lunar halo on the 12th.

Thunder-storms occurred on the 11th, 13th and 19th.

There was a light frost on the 23d.

The prevailing wind was southwest.

June.

The mean barometer was 30.011. The highest barometer, 30.396, occurred on the 24th; and the lowest, 29.735, on the 18th.

The mean relative humidity was 82 per cent.

The mean temperature was 67.1°; the highest temperature, 85° on the 16th and 29th; and the lowest, 42°, on the 1st. Five days were clear, 13 fair and 12 cloudy.

Rain fell on 20 days, and the total rainfall was 2.08 inches, this being about 1.19 inches below the Station average. The heaviest rainfall was 0.36 inch on the 25th. Thunder-storms occurred on the 14th, 15th, 16th, 17th, 18th, 27th, 28th and 30th. A fog occurred on the 24th.

A lunar halo was observed on the 9th.

The prevailing wind was southwest.

July.

The mean barometer was 29.976. The highest barometer, 30.235, occurred on the 6th; the lowest, 29.682, on the 19th.

The mean relative humidity was 78.1 per cent.

The mean temperature was 73°; the highest temperature, 92°, on the 8th, 9th and 10th; and the lowest, 49°, on the 16th.

Most of the month was either clear or fair, but rain fell on 14 days, giving a total rainfall of 2.85 inches, of which 0.93 inch fell on the 14th. Thunder-storms occurred on the 3d, 13th, 14th, 18th, 19th, 20th and 28th. A fog occurred on the morning of the 30th.

The prevailing wind was southwest.

August.

The mean barometer was 30.118. The highest barometer, 30.254, occurred on the 27th; the lowest, 29.763, on the 14th.

The mean relative humidity was 75.5 per cent. The mean temperature was 68.8°; the highest, 93°, on the 31st; and the lowest, 40°, on the 15th.

Clear weather predominated, the sky being less than three-tenths covered with clouds on 20 days. Rain fell on 10 days, but on two of these only a trace. The total rainfall was 2.07 inches, of which 1.78 inches fell on three days, viz.: 0.74 inch on the 2d, 0.53 inch on the 4th, and 0.51 inch on the 10th.

Thunder-storms occurred on the 2d, 4th and 9th.

A solar halo was observed on the 23d.

The prevailing wind was northwest.

September.

The mean barometer was 30.042. The highest barometer, 30.344, occurred on the 27th, and the lowest, 29.546, on the 20th.

The mean relative humidity was 79 per cent.

The mean temperature was 62.6°; the highest temperature, 93°, on the 1st, and the lowest, 31°, on the 22d.

Clear and fair weather was the rule; rain fell on 13 days, on two of which only a trace fell.

The total rainfall was 3.77 inches. The heaviest rainfall was 0.83 inch on the 15th, and 0.83 inch on the 16th, occurring consecutively, and making for one rain a total of 1.66 inches.

Thunder-storms occurred on the 2d and 15th.

Frost was seen on the 21st, 22d, 27th and 28th.

A fog occurred on the morning of the 15th.

Prevailing wind was south.

October.

The mean barometer was 30.106. The highest barometer, 30.385, occurred on the 23d, and the lowest, 29.696, on the 25th.

The mean relative humidity was 77.1 per cent.

The mean temperature was 47.1°; the highest temperature, 79°, on the 11th, and the lowest, 22°, on the 8th.

During this month 14 days were clear, 6 fair, and 11 cloudy. Rain fell on 11 days and the total rainfall was 1.79 inches. The heaviest rainfall, 0.86 inch, occurred on the 25th, 26th and 27th, consecutively. Light frosts occurred on the 5th, 9th, 10th, 11th and 19th; heavy frosts on the 7th, 8th, 15th, 16th, 21st and 24th.

Ice was observed on the 7th, 8th and 24th.

A fog occurred on the morning of the 5th.

Prevailing wind was north.

November.

The mean barometer was 30.085. The highest barometer, 30.640, occurred on the 16th, and the lowest, 29.465, on the 21st.

The mean relative humidity was 85.7 per cent.

The mean temperature was 40.7°; the highest temperature, 66°, on the 1st, and the lowest, 21°, on the 30th.

Cloudy weather was in excess; rain fell on 17 days, and snow on 2.

The total rainfall was 3.72 inches, and the heaviest daily rainfall, 0.89 inch, occurred on the 8th. Numerous hard frosts occurred during the month, and the last three days were characterized by a high west wind, light snow, and temperatures ranging from 21° to 38°. The total snowfall was less than an inch.

Lunar halos were observed on the 4th and 9th.

The prevailing wind was west.

December.

The mean barometer was 30.135. The highest barometer, 30.603, occurred on the 30th, and the lowest, 29.651, on the 29th. Several days of the month were marked by rapid changes in air pressure.

The mean relative humidity was 80.4 per cent. The mean temperature was 43.6°, which is 12.1° above the Station average, and is our highest December mean.

The highest temperature, 67°, occurred on the 29th. The lowest temperature, 17°, occurred on the 1st, and is the highest minimum temperature for this month at the Station since 1884.

In this month 11 days were clear, 10 fair and 10 cloudy.

The total rainfall for the month was 2.24 inches. The heaviest rainfall, 1.29 inches, occurred on the 10th and 11th.

Thunder-storms occurred on the 10th and 21st.

Sleet fell on the 3d, but no snow was observed during the month.

A solar halo was seen on the 29th, and lunar halos on the 4th, 9th and 28th.

The prevailing wind was south

W. H. BAKER, *Meteorologist.*

THE INSECT RECORD FOR 1889.

BY CLARENCE M. WEED, ENTOMOLOGIST AND BOTANIST.

The honors for entomological notoriety in Ohio during the season of 1889 will clearly have to be divided between two insects whose reputations as mischief-makers are of long standing. One of these is the GRAIN PLANT LOUSE, and the other is the WHITE GRUB. While the former undoubtedly created the greater excitement, and was more talked about during its brief career, it is equally certain that the latter has kept more steadily at work and done by far the greater damage.

The GRAIN PLANT LOUSE (*Siphonophora avenæ*), the wingless form of which is shown much magnified at Fig. 49, began to attract attention

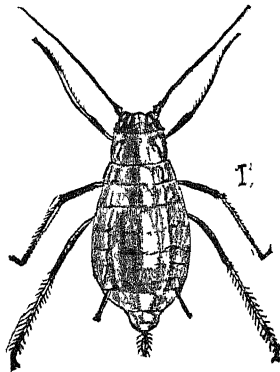


FIG. 49. *Grain Plant Louse.* (Original).

early in June, when farmers in all portions of the State commenced sending it to the Station with requests for information concerning its habits and the probabilities of injury. A circular, giving a short account of the insect, was issued in June. Serious damage was undoubtedly done to the late wheat in many counties of the State, though that which ripened early, as a rule, was not noticeably injured.

But the most remarkable occurrence of the outbreak was the suddenness with which it was checked by the appearance, in the infested fields, of enormous numbers of various species of parasitic and predaceous

insects. Chief among these were certain lady-bird beetles (*Coccinellidæ*), lace-wing larvæ (*Chrysopa*), syrphus fly larvæ, and small four-winged parasitic flies of the order Hymenoptera. In one field we found that nearly six per cent. of the wheat stalks were inhabited by some form of these lady-bird beetles. The outbreak was checked so suddenly that, although the insects had gotten well started in the oats fields, where they threatened to do serious damage, they were so cleaned out by the time the crop was harvested as to be difficult to find.

The WHITE GRUB has been extraordinarily abundant during the season, and has done a great deal of damage in widely separated portions of the State. It seems especially to have abounded in the southern counties, where bitter complaints are to be heard concerning it at every gathering of farmers; but it has been also abundant in northern Ohio, as is shown by the statement of Mr. Mathew Crawford, that thirty-seven grubs were taken from about the roots of a single strawberry plant at Cuyahoga Falls. This insect seems to be to Ohio what the Chinch Bug is to Illinois, Missouri and Kansas, although I am inclined to think it even more difficult to overcome. Mr. T. B. Terry has expressed the opinion that short rotations and high farming will prevent its ravages; and it seems probable that the pest may best be brought into subjection by the most improved agricultural methods, rather than by topical applications to destroy the insect after it is present.

Although it cannot be doubted that a vast amount of damage has been done during the year by the White Grub, I am convinced, from correspondence and interviews with some of the most intelligent farmers of southern Ohio, that a large proportion of the injury to corn in that region generally attributed to this pest, is really due to one or both of two other insects. The first of these is the CORN ROOT LOUSE, and the other is some CORN ROOT WORM, although I do not think the latter is the species which commonly goes by this name in Illinois and adjacent States.

The CORN ROOT LOUSE (*Aphis maidis*) was evidently exceedingly numerous last spring in the southern counties of Ohio. It is a small bluish louse which congregates in great numbers, upon the roots of the young corn plants, sucking the sap and causing the plants to turn yellow and often to die. It is always attended by a small brown ant which protects it carefully, but which does no direct damage to the corn.

My attention was called to the presence of a CORN ROOT WORM by Mr. J. M. Allen, of Fayette county, who in a letter dated December 16, 1889, wrote:

I am of the opinion that not more than ten per cent. of the damage to corn was done by the White Grub, but by a much more dangerous and destructive foe—the Corn

Root Worm. I noticed five years ago small spots of clay ground corn that did not seem to grow well. It came up and started all right, but the last of May and first of June found it making very slender growth, and nearly at a standstill. Close examination found the roots being consumed by a small threadlike worm. This pest seemed to confine its work entirely to the clay land corn at first, but has increased from year to year so fast that the whole earth seems to be in its possession. I have thirty-four acres of corn on clover sod, planted in good time and cultivated with more than ordinary care. The yield is thirty bushels per acre of light, chaffy and rotten corn, too poor to place on the market at No. 3 grade. * * * My present crop tumbled down and lodged badly - cause of the cutting away of the roots by this pest.

While attending institutes in Clermont and adjacent counties, I inquired concerning the presence of such a root worm in corn as Mr. Allen describes, and his account was corroborated by many intelligent and observing farmers. The reason why I think the insect is not the species found in Illinois is, that although I have had collections of insects made during the last two years in many parts of Ohio—particularly in Warren and Lawrence counties in the southern part of the State—not a single specimen of the genuine Corn Root Worm Beetle (*Diabrotica longicornis*) has been taken. This beetle resembles in size and form the common Striped Cucumber Beetle, to which it is closely related, but is of a uniform green color. I should be glad to hear from any farmer having experience with these corn insects; and hope to determine definitely the main facts of the case by field investigations the coming season. It is probable that the culprit will prove to be the larva of the Twelve-Spotted Cucumber Beetle (*Diabrotica 12-punctata*), an insect closely related to the two species above mentioned, which is very abundant in southern Ohio, and which has been known for some time to breed in corn. It seems especially likely that this is the species at work, on account of the fact that Professor H. Garman, entomologist to the Kentucky Experiment Station, has recently discovered that this insect breeds abundantly in corn roots in that State, frequently doing very serious mischief. He finds that the previous crop of the field has very little to do with the amount of damage—a condition which agrees with the account given above by Mr. Allen.

The HESSIAN FLY (*Cecidomyia destructor*) has, at least so far as can be judged from the reports that have reached this Station, done very little damage. This insect seems at present to be below its normal limit, probably on account of its numerous parasites.

The prediction made one year ago, in my Insect Record for 1888, that the further increase of the CHINCH BUG (*Blissus leucopterus*) would probably be checked by the fungous diseases which had appeared among those then present, seems to have been justified by this season's experience. Although this pest had done much damage in many counties of the State

ANNUAL REPORT

during 1888, I have heard of their presence but once this year, and so far as the information at hand goes, they have done no injury. Farmers should be on the watch for them however, during this winter and the coming spring, as it is possible that enough have escaped the disease to restock the infested area in a short time. In the vicinity of Columbus this, indeed, seems to be the case, as the bugs have been very frequently found during our fall and winter collecting.

The common indigenous grasshoppers appear to have been locally injurious in certain portions of the State. The most serious outbreak of which I have heard, occurred on the farm of Mr. James B. Holman, near Williamsburg, Clermont county. The second growth of a twelve-acre clover field was completely destroyed by them—the most abundant species being the common RED-LEGGED GRASSHOPPER (*Caloptenus femur-rubrum*). After the clover had been taken the insects migrated to neighboring corn fields, where much damage was also done.

Attention was called in the Annual Report of this Station for 1888¹ (pp. 133-134), to a new method of preventing the injuries of the CLOVER SEED MIDGE (*Cecidomyia leguminicola*) originating with Mr. John Warren, of Medina county, Ohio. This method consists in mowing the field about the middle of May, when the green clover heads are just forming, and leaving the partial crop thus cut, on the ground as a mulch and fertilizer. A new crop of blossoms is then produced, which comes between the regular crops and also between the two broods of the Midge—thus escaping attack. Mr. T. B. Terry, of Summit county, informs me that he tried this method the past season in one of his fields with gratifying results. The mower was run through the field May 15, and there soon appeared a remarkable crop of blossoms, which set a good crop of seed. Mr. Terry pronounces the remedy a perfect one.

In the October Bulletin of this Station I published a bibliography of insects affecting CLOVER, together with a systematic list of the species discussed. In this list eighty-two insects are enumerated. Since then I have learned of at least four additional species which prey upon this plant. Two of these are butterflies, *Cyaniris pseudargiolus* and *Epargyreus tyrus*, to which my attention has kindly been called by Mr. Samuel H. Scudder, of Cambridge, Mass. The other two are plant-lice—*Aphis trifolii*, Oestlund, and *Callipterus trifolii*, Monell.

In last year's report of this Station I recorded the results of the first season's work upon a series of experiments undertaken to determine whether the ravages of the PLUM CURCULIO (*Conotrachelus nenuphar*) can be prevented by spraying with the arsenites—London purple or Paris green. These results indicated that this remedy is a practical and effective one. The results of the second season's work upon these experiments

were reported in the September Bulletin. Suffice it to say here that they were sufficient to justify the conclusion that "Spraying with the arsenites is cheaper and more practical than any other known method of preventing the injuries of this insect." The experience of a number of practical orchardists who have sprayed their plum trees this season also points to the same conclusion.

The injuries of the CODLING MOTH (*Carpocapsa pomonella*) have continued as in previous years, except in those orchards which were sprayed with the arsenites, where, so far as can be judged from the reports at hand, the crops have been practically free from worms. The practice of spraying continues to grow in favor, and is rapidly becoming recognized as an essential part of the procedure of the successful horticulturist.

The large green "worms" or caterpillars which attack tomato and tobacco plants, and are commonly called tomato worms or tobacco worms, attracted considerable attention during the season on account of a small parasite which spins cocoons upon the backs of the caterpillars, as represented in Fig. 50. These cocoons are ordinarily mistaken for the eggs of



FIG. 50. *Tomato Worm with Cocoons of Parasite.* (Original).

the caterpillar. Their origin may be explained as follows: Some fine day when the caterpillar is enjoying his usual meal of foliage or fruit, a small, black, four-winged fly alights upon his back and deposits beneath his skin great numbers of small eggs. In a few days these eggs hatch into little legless grubs, which absorb the fatty juices of the caterpillar and develop at his expense. In a few weeks the Tomato Worm stops feeding, its body being literally full of the grubs. When full grown these grubs bore holes in the back of their host and crawl through the skin, when they begin spinning the white silken cocoons already mentioned. Within these cocoons they change to the pupa state, and in about a fortnight

emerge as four-winged flies, like those by which the original eggs were laid.

There are probably few injurious insects for which more remedies have been suggested than the STRIPED CUCUMBER BEETLE (*Diabrotica vittata*). Every year dozens of these remedies are recommended through the newspapers as specifics for the pest, and occasionally some of the most worthless of them even get between the covers of official entomological reports. In order to obtain a more definite knowledge than is now possessed of the preventive or remedial value of these various substances, a series of experiments has been undertaken in which it is designed to give each a practical field test, and if possible, ultimately to arrive at some definite conclusions for the guidance of the interested public. The results of the first season's work have been reported in the September Bulletin. The most satisfactory method employed was that of fencing out the insects by covering the plants with some form of tent or gauze covered frame. This may be done by simply placing over the plants a piece of thin plant-cloth or

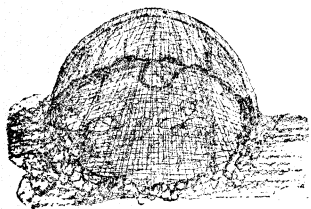


FIG. 51. (Original).

cheese-cloth, about two feet square, and fastening the edges down by loose earth. It is better, however, to hold the center of the cloth up by means of a half barrel hoop, as shown

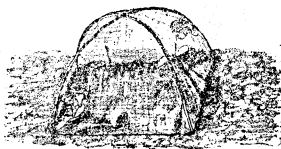


FIG. 52. (Original).

at Fig. 51, or wires bent in the form of a croquet arch, as shown at Fig. 52. I hope to continue these experiments the coming season, and would be glad to hear from any readers who have had experience in fighting this insect.

The injuries of the BEAN WEEVIL (*Bruchus obsoletus*) have apparently continued with undiminished severity. Many complaints concerning them have reached the Station, and the question is frequently asked as to how they may be destroyed as soon as the crop is harvested, and before they have undergone their transformations. The method proposed in last year's Report of this Station—that of subjecting the beans to a temperature of 145° Fahr.—seems yet to be the most feasible one suggested.

The injuries of the PEAR OR CHERRY-TREE SLUG have been extraordinarily severe during the past season in many parts of Ohio. Large numbers of trees were completely defoliated by the pest; and a third brood of the larvæ appeared in the central part of the State during September and October. A series of experiments with remedies was conducted by us, and the conclusion was reached that the Slugs can very easily be destroyed by applying pyrethrum, hellebore, or London purple to the foliage on which they are feeding. Probably spraying with the arsenites,

where this can be done without danger to fruit, will be the easiest way to get rid of them.

Two common leaf hoppers, the GREEN APPLE-LEAF HOPPER (*Empoasca albopicta*),* shown magnified at Fig. 53, and the ROSE-LEAF HOPPER (*Typlocyba rosæ*), also shown magnified at Fig. 54, have been exceedingly abundant and destructive during the season. The injuries of the former were most noticeable on currants and gooseberries, while the latter confined itself, as usual, to roses. Our experiments this year confirm those of last in showing that these insects are easily destroyed in their immature stages by pyrethrum, tobacco dust and similar insecticides.

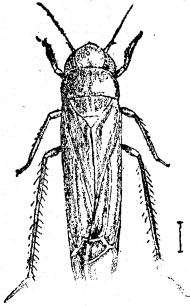


FIG. 54. (Original).



FIG. 53. (Original)

The IMPORTED CABBAGE WORM (*Pieris rapæ*), has been nearly as abundant as usual during the season, although in some parts of the State, particularly in Franklin county, it was checked to a considerable extent by certain common parasites, and the contagious disease described by Professor S. A. Forbes as *flacherie*.

During August our attention was called to a new and important insect enemy of the strawberry—the STRAWBERRY ROOT LOUSE (*Aphis forbesi*, Weed). This little pest appears to be very generally distributed over the State. Recent observations have confirmed Professor Forbes' statement that eggs are laid in autumn. As to remedies, I can only repeat a paragraph already published to the effect that with our present knowledge of the life history of the insect, rotation appears to be the most promising method of preventing its injuries. If it should be found that there is no winged brood, though from analogy we would naturally expect that there is one, this will be an easy and complete remedy, while if there is a winged brood it will only be a partial protection. But in either case it will not be advisable to set new plantations with plants from infested fields, for it will be almost certain that some of the lice will thus be introduced into the new field. The plants for setting, however, may be disinfected by dipping in kerosene emulsion.

Popular attention, especially in cities where electric lights were in use, was considerably attracted during the early summer months to the GIANT WATER BUGS, or ELECTRIC LIGHT BUGS, as they have lately frequently been called. There are two distinct species of these bugs, so

*On account of an oversight this species was referred to the genus *Typlocyba* in the September Bulletin. It probably belongs to *Empoasca*, as shown by Mr. C. W. Woodworth (*Psyche* v. 5, p. 213).

similar in appearance and habits that they have often been confounded even by entomologists. The commonest species is technically known as *Benacus griseus*, and the rarer one is called *Belostoma americanum*. The

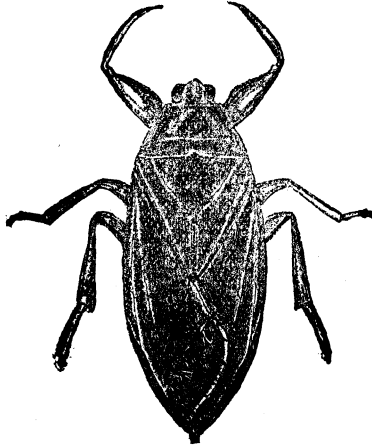


FIG. 55. (Original).

latter is shown at Fig. 55. These insects are aquatic in their habits, preying upon various water animals. A short account of their eggs will be found in the October Bulletin of this Station.